The auto $mart Guide

HOW TO BUY, DRIVE AND MAINTAIN YOUR CAR THE AUTO$MART WAY – AND SAVE MONEY, ENERGY AND THE ENVIRONMENT.

You, the new car buyer

The cost of driving

Keeping your car in shape

Fuel alternatives

Your car and the environment

Natural Resources Canada
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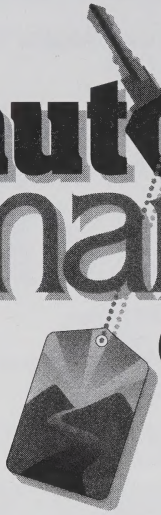
The auto $mart Guide



HOW TO BUY, DRIVE AND MAINTAIN YOUR CAR THE AUTO$MART WAY – AND SAVE MONEY, ENERGY AND THE ENVIRONMENT.

Introduction

Canadians are driving farther and more often than ever before.

Combine this with Canadians' love affair with the car (with close to one vehicle for every two Canadians, we've got one of the highest ratios of car ownership in the world) and you've got a compelling situation driving the need for this book – *THE AUTO$MART GUIDE: How to buy, drive and maintain your car the Auto$mart way – and save money, energy and the environment.* Here's a quick overview of how it can directly benefit you.

Save money.

How much do you spend on fuel every month? What does that work out to over an entire year? How much money does that represent over a decade?

For a Canadian who spends $100 a month on fuel, or $1,200 per year, that represents $12,000 in fuel costs alone over 10 years. So when you read in this book about saving 10 per cent of your fuel here, and 15 per cent there, plus an additional five per cent by doing this or that, you'll appreciate that it amounts to *a lot of money.*

Save energy.

Over the past 25 years, passenger car registrations in Canada have increased by more than 104 per cent. And truck registrations are up by 153 per cent!

More vehicles, of course, means more fuel used. In fact, transportation energy demand in Canada is projected to increase by close to 40 per cent over the next 25 years!

Just think how much energy we could save if we all did even a few small things about cutting back on our fuel use. We could save, literally, billions of litres of fuel.

Save the environment – and save ourselves.

Vehicle emissions contribute directly to smog, acid rain and global warming.

For example, ground-level ozone – or smog – is not only harmful to vegetation. It also harms people by irritating the eyes and lungs. Shortness of breath, pain when taking deep breaths, wheezing, fatigue, headaches and nausea can all result from exposure to smog.

More than half of all Canadians are exposed to high levels of ground-level ozone every summer.

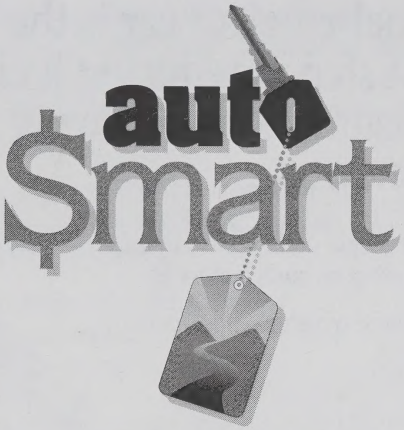
Children, because they are still growing, are more vulnerable than adults to air pollutants. They are also generally exposed to more air pollutants than adults because they breathe faster and, in the summer, spend more time outdoors being physically active.

Driving into the future – the Auto$mart way.

Save money. Save energy. Save the environment. And save ourselves. Those are all compelling reasons why we should all become Auto$mart drivers.

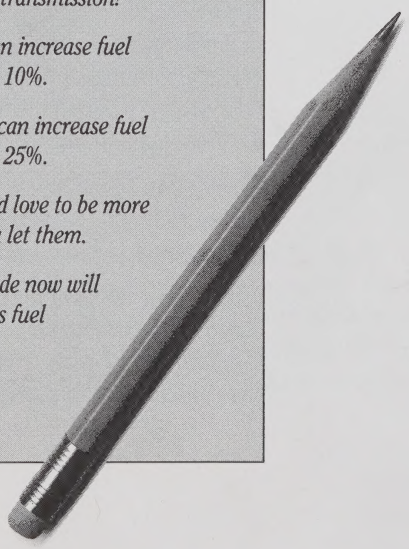
We hope this book encourages you to embark on an Auto$mart journey. Through reading and learning, then by abandoning old habits and following new ones, you'll see how easy and rewarding it is to buy, drive, and maintain your vehicle the Auto$mart way.

If, after you've read this book, you have any questions, or if you'd like a copy of the *Fuel Consumption Guide* published by Natural Resources Canada and Transport Canada, **call the Auto$mart Hotline at 1-800-387-2000.**



You, the new car buyer

- ☑ *A fuel-efficient car is the first step in reducing fuel consumption and saving money.*
- ☑ *Get – and read – the* Fuel Consumption Guide.
- ☑ *Is a manual transmission more fuel efficient than an automatic transmission?*
- ☑ *Air conditioning can increase fuel consumption up to 10%.*
- ☑ *A loaded roof rack can increase fuel consumption up to 25%.*
- ☑ *Most vehicles would love to be more fuel efficient, if you let them.*
- ☑ *Buying choices made now will affect your vehicle's fuel economy for life.*

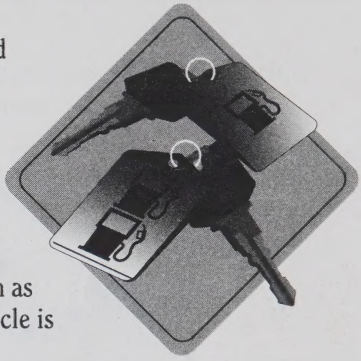


A fuel-efficient car is the first step in reducing fuel consumption and saving money.

Many people don't realize that fuel consumption varies greatly depending on such factors as:

- the type of vehicle purchased
- weight
- transmission
- engine efficiency
- accessories and options

as well as external factors such as how, when and where the vehicle is driven.



Get – and read – the *Fuel Consumption Guide.*

To help you decide which type of vehicle would be the most fuel efficient for your needs, Natural Resources Canada and Transport Canada publish the *Fuel Consumption Guide*, which lists the fuel consumption ratings of most new automobiles, light trucks and vans sold in Canada.

If you do not have the guide, check the fuel consumption label affixed to most new vehicles. If you don't see a label, ask the dealer about the vehicle's fuel consumption ratings.

After you've decided on the size and type of vehicle you need, based on your lifestyle and *regular* requirements, use the *Fuel Consumption Guide* to compare the consumption ratings of the vehicles you're considering.

(If you're contemplating a larger vehicle for that once-a-year vacation with the whole family or for chauffeuring the team to those weekend tournaments, you may want to consider renting that larger vehicle only when it's needed. You'll save money and fuel.)

For your free *Fuel Consumption Guide,* **call the Auto$mart Hotline at 1-800-387-2000.**

Remember that the ratings of different vehicle makes and models vary considerably. You should also note that the ratings are determined in a controlled laboratory setting, thus ensuring that all vehicles are tested under identical conditions. The fuel consumption of your vehicle will vary depending on how you drive, the season, the types of optional equipment installed and the condition of your vehicle.

Is a manual transmission more fuel efficient than an automatic transmission? Well, it depends.

Transmissions

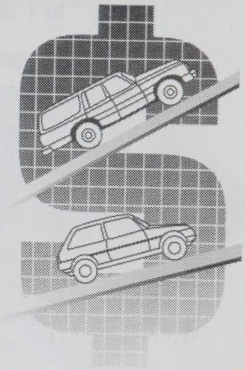
Transmissions with a wider range of gear choices will almost always deliver improved fuel economy.

A transmission with four forward speeds is usually more efficient than one with three forward speeds, especially on the highway. Manual transmissions are usually more efficient than automatic transmissions, although this is not always the case. Consult the *Fuel Consumption Guide* and make your own comparisons.

Overdrive gears, available in most of today's transmissions, provide better fuel economy during highway driving. Overdrive decreases the engine speed while maintaining the same overall vehicle speed, thus reducing both fuel consumption and engine wear.

Vehicle weight

Whatever kind of vehicle you purchase, remember that, generally, the *lighter the vehicle, the more fuel efficient it will be.*



Most manufacturers have been "downsizing" their vehicles by designing them to weigh less and to make better use of space and materials. By using high-strength steels, plus lightweight materials and plastics, vehicle weight can be reduced.

Engines

Generally, *the larger the engine, the greater its fuel consumption rate will be*. A vehicle with a 2.2 L engine will likely have a lower fuel consumption rate than one with a 5.0 L engine – simply because the smaller engine uses less fuel.

Manufacturers have been improving engine fuel efficiency by reducing the engine's internal friction and by introducing new design features, such as three and four valves per cylinder, turbochargers, high swirl, fast-burn combustion chambers and electronic fuel-injection systems.

With more vehicles on the road using the ever-improving electronic controls that are standard equipment on today's cars, we should see further improvements in fuel efficiency.

.....Air conditioning can increase fuel consumption by up to 10%.

When choosing options, know that air conditioners impose an extra load on the engine, making it work harder and burn more fuel. Certain common options, like power windows and power seats, add weight that also make the engine less efficient.

Air conditioners, used in stop-and-go traffic, can increase your fuel consumption by as much as 10 per cent. At highway speeds, air conditioning increases fuel consumption by three to four per cent.

Flow-through ventilation reduces the need to drive with air conditioning on or with windows open, both of which consume more fuel.

A sun roof can reduce the need for an air conditioner, but when the roof is open at highway speeds, aerodynamic drag is increased and greater fuel consumption will result.

Tinted glass keeps cars cooler, can reduce the need for air conditioning and lessens eye strain in bright light, but reduces visibility at night.

A loaded roof rack can increase fuel consumption by up to 5%.

A roof-top carrier provides additional baggage space and may allow you to meet all your driving needs with a smaller vehicle.

However, a loaded rack can increase fuel consumption by as much as five per cent in highway driving. Even the most streamlined empty rack will increase fuel consumption by about one per cent when it's not loaded. If the carrier is not permanently affixed to your automobile, remove it when it is not needed.

A heavy-duty suspension system improves handling characteristics and is stronger and longer lasting than a standard one. The added weight, energy and cost penalty are nominal.

.....Most vehicles would love to be more fuel efficient, if you let them.

Fuel economy reminders (or shift indicator lights) are offered on some vehicles with manual transmissions as a guide to shifting gears for the best possible fuel economy. Usually the device is a light, connected to the car's computer, that comes on when it's appropriate to shift into the next higher gear.

Cruise control allows you to set the car's cruising speed, take your foot off the gas pedal and relax. By maintaining a constant speed on long trips, your cruise control feature may reduce fuel consumption, provided the terrain is relatively flat and you keep your speed down.

Front-wheel drive generally means reduced weight, which translates to better fuel economy. As well, front-wheel drive generally offers better traction and increased space in the passenger compartment.

Four-wheel drive means that all four wheels are capable of transmitting torque to the road. Four-wheel drive offers traction and braking advantages under slippery conditions, yet this extra capability carries fuel-economy penalties. The most fuel-efficient systems disengage the four-wheel drive when extra traction is not needed.

Buying choices made now will affect your vehicle's fuel economy for life.

Electronically controlled fuel-injection systems (EFI) meter the exact amount of fuel the engine needs for efficient combustion. Fuel injection is being chosen by most car manufacturers today, as it *offers better cold-starting performance, smoother idle, lower fuel consumption and lower exhaust emissions* than carburetor-equipped vehicles.

Turbocharging uses the energy in hot exhaust gases to drive a compressor that forces additional air into the engine. Because the turbocharger is controlled to operate only when increased power is needed, a turbocharged engine provides better fuel economy than a larger, non-turbocharged engine.

Yet, since the need for increased power (for example, when passing, or when merging with, fast-moving traffic) consumes an inordinate amount of fuel, turbocharging cannot be considered a fuel-efficient feature.

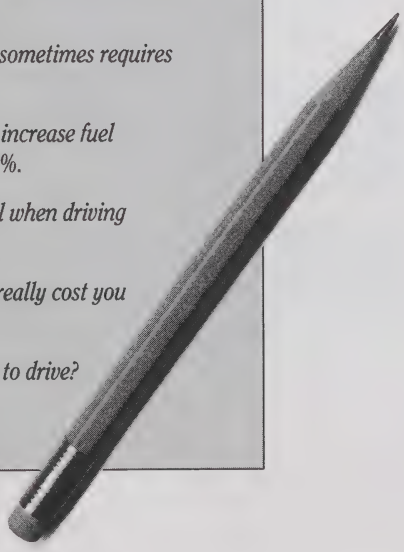
Disc brakes offer superior performance to drum brakes.

Diesel engines offer greater fuel efficiency and longer driving range between fill-ups, and should be investigated by the cost-conscious vehicle buyer.

A block heater not only assists in starting your car in cold weather, but also reduces fuel consumption by allowing you to start out with a semi-warm engine. The block heater need not be left on all night. A timer can be set to automatically turn the heater on one or two hours before you plan to start your vehicle.

The cost of driving

- ☑ *A poorly tuned engine can increase fuel consumption by 15 to more than 50%.*
- ☑ *Driving 90 km/h rather than 100 km/h can reduce fuel consumption by 10%.*
- ☑ *Underinflated tires can increase your fuel consumption by 5%.*
- ☑ *Auto$mart driving sometimes requires some planning.*
- ☑ *Winter driving can increase fuel consumption by 50%.*
- ☑ *How to use less fuel when driving in winter.*
- ☑ *How much does it really cost you to drive?*
- ☑ *Do you really need to drive?*



A poorly tuned engine can increase fuel consumption by 15 to more than 50%.

By properly maintaining your car and by following the recommended maintenance schedule in your owner's manual, you can maximize fuel efficiency. *A poorly tuned engine can increase fuel consumption by up to 50 per cent or more*. With a well-tuned engine, you'll also minimize engine wear and tear.

Idling consumes fuel, no matter how efficient your car is. *One minute of idling uses up more fuel than restarting your engine*. Turn off the ignition if you are waiting for someone.

Never rest your left foot on the brake pedal while driving. Doing so increases the temperature of the brake components, thus reducing their efficiency. It also reduces the life of the brake linings and causes the engine to work harder than necessary. It's also a safety hazard, because it keeps the brake lights on continuously.

Heavy bags of sand and salt in the trunk serve no useful purpose in spring, summer and fall. Extra weight means wasted fuel and money.

Driving 90 km/h rather than 100 km/h can reduce fuel consumption by 10%.

Maintain posted highway speeds. Tests show that most cars use about 10 per cent less fuel when driven at 90 km/h instead of 100 km/h. And if you drive at 110 km/h rather than 90 km/h, you'll increase fuel consumption by about 20 per cent!

Accelerate smoothly when passing other cars or merging with faster traffic.

Anticipate traffic ahead of you so you can adjust your speed to changes in traffic flow. This defensive driving technique gives a smoother, safer ride, and is very fuel efficient.

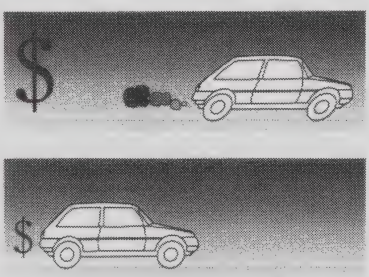
Keep records of your vehicle's fuel consumption and review them regularly to be aware of sudden changes in fuel efficiency. If there is a sudden change, the vehicle may have a leak or mechanical problems, or may be in need of a tune-up. Or, perhaps, your driving style has changed.

Call the Auto$mart Hotline at 1-800-387-2000 and get your free *Car Economy Calculator*, then keep a record of your fuel consumption and challenge yourself to reduce it.

Underinflated tires can increase your fuel consumption by 5%.

Purchase a good quality air pressure gauge and check the inflation pressure of your tires once a month. Underinflated tires wear out faster, waste fuel and are unsafe. Keep your tire inflated to the pressure specified by the vehicle manufacturer. (The manufacturer's suggested inflation pressure will usually be found on a label located in the glove compartment, on a door post, or in your owner's manual.) If a recommended range is given, use the higher pressure.

Avoid jackrabbit starts. These abrupt, aggressive starts are hard on the tires, guzzle gas and do not get you to your destination noticeably faster.



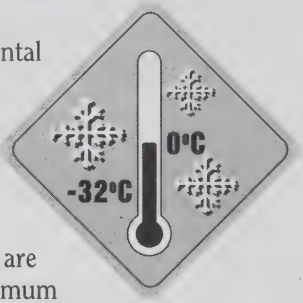
Anticipate stops. Avoiding abrupt stops will save gas and reduce wear on tires and brakes.

Auto$mart driving sometimes requires some planning.

Plan ahead to allow yourself sufficient time to reach your destination. Driving "against the clock" leads to speeding and wastes fuel.

Try to avoid traffic jams by staggering your working hours, or by following alternative routes suggested in radio traffic reports. Save time, as well as gas.

Winter driving can increase fuel consumption by 50%.



One of the most important environmental factors affecting fuel consumption is temperature. At -20° C, for example, the average engine needs at least five kilometres of *driving* to fully warm up.

Exhaust emissions from a cold engine are much higher, because to work at maximum efficiency, your vehicle's catalytic converter must first reach its normal operating temperature of about 390° C. On days when the temperature is well below freezing, use of a block heater and driving away as soon as possible will heat up the engine and catalytic converter and help to reduce emissions.

On short trips in cold weather *a gasoline engine will use up to 50 per cent more fuel* than in warm weather. Snow and slush also increase fuel use because the tires act as ploughs, or they spin and use energy to go nowhere.

Winter driving in cold Canadian winters requires more care and caution than summer driving, so be prepared for increased travelling time and fuel consumption.

How to use less fuel when driving in winter.

Get your car ready before winter comes. Give your car a full tune-up in the fall, including changing your oil to a light-weight multigrade. A heavy oil will thicken in winter, making it harder for the engine to turn over.

Use a timer to switch on your block heater one or two hours before you plan to drive. A warm engine means easier starting, fewer emissions, and less need for idling.

Snow tires save fuel in the winter by giving better traction on snow and ice. If, however, they are kept on in spring and summer, they *increase* fuel consumption.

Remove as much snow and ice as possible from your car before you drive. You'll get better fuel economy *and* maximum visibility.

How much does it really cost you to drive?

First, the good news.

Compared to vehicles on the market 15 years ago, new technologies have contributed to a substantial decrease in gasoline consumption.

And the bad news?

Well, the cost of driving a vehicle is, unfortunately, not getting any cheaper. For starters, there's the increasing price of new vehicles and increased fuel prices. Plus, as mentioned earlier, we, as Canadians, are driving farther and more often. Overall, it all adds up to higher costs of driving.

But you can buck this general trend – by doing the right things.

Car costs can be broken down into two categories: fixed costs, and variable or operating costs.

Fixed costs include the capital cost of the car, interest, depreciation, insurance, and licence and registration fees. The fixed costs do not vary with the amount and type of driving except for depreciation, which is the difference between the purchase price of your car and the price it could be sold for given its age, number of kilometres and condition.

The high – and unavoidable – cost of depreciation

After the initial cost of purchasing a new car, the next greatest expense for the buyer is depreciation. If you sell your new car after only one year, you must expect its value to have depreciated by approximately 25 to 30 per cent.

The depreciation rate decreases with each subsequent year. Licence and registration fees and insurance are fixed annual costs.

The high – yet avoidable – costs of vehicle operation

Variable or operating costs differ greatly depending on how and where the car is driven, the type of driving (city versus highway), the condition of the car, environmental conditions, and, of course, the type of car you drive.

With regard to the trend to keeping vehicles longer, purchasing the right vehicle becomes even more important. The difference between a car burning 13 L of fuel every 100 km and one burning 10 L over five years of ownership is about $1200 at current gas prices and average driving patterns.

Once you have chosen the size and type of vehicle you want, you owe it to yourself to check the *Fuel Consumption Guide* to see what other similar sized vehicles can do.

Imagine the additional savings that could be yours if you practised the driving and maintenance tips in this book!

Maintenance and tire costs are also variable. A properly maintained car will always last longer and be cheaper to operate over the years.

High speeds, hot weather, hard cornering, rough roads, rapid acceleration and abrupt stops all contribute to fast tire wear and increased costs. Costly repairs tend to be more frequent on a car that is driven hard.

Think about it. Most variable costs can be reduced substantially by driving only when necessary and in a fuel-efficient manner.

NOTE: For additional information on the costs of driving, owning and operating your automobile, write to the Canadian Automobile Association, 1775 Courtwood Crescent, Ottawa, Ontario K2C 3J2. Ask for the free brochure entitled Car Costs, *and enclose a self-addressed, stamped, business-sized envelope.*

Do you really need to drive?

If you want to save fuel and money, there are many alternatives to driving your own car.

The most energy-efficient and least costly mode of transportation is muscle power. If you live three or four kilometres (or less) from work or some other regular destination, why not walk or ride a bike in mild weather?

And how about year-round public transit? If it is inadequate in your area, consider contacting your municipality. The more people who indicate the need for better service, the sooner it will happen.

Certain trips, however, cannot be made on a bike or a city bus – the trip from Montréal to Toronto or from Calgary to Edmonton, for example. Taking an intercity bus or train is a fuel-efficient alternative to driving alone.

Using a car can also be economical if you share the costs with others. If you need a car only on rare occasions, rent one or borrow a friend's.

Of course, if you have a car, you have perceived a need for it. Perhaps it's required to drive your children to sporting or educational activities and you to your work. The car may be a necessity for you, but even a necessity can be used advantageously.

Consider alternating the driving with others whose children attend the same activities as your children do. As for commuting to and from work, why not ride-share with your neighbour?

Drive your car only when necessary. Don't use it for those "around the corner" trips...walk instead. Plan your trips. Don't make two trips when one will do.

So before you put your foot on the gas pedal, ask yourself, "Do I really need to drive?" Asking yourself this question alone, then honestly answering it, will clearly save fuel dollars.

A single bus can take 40 vehicles off the road

Our automobiles are major contributors to smog, acid rain and global warming. While most individuals feel they cannot afford to give up the family car, there are plenty of ways to reduce its impact on the environment.

The best way to reduce emissions, reduce energy waste, and save money at the same time is to drive only when necessary. Take the healthy route and walk. Or ride a bike. Many employers and schools make bike racks and change facilities available.

Use public transit. Transit is cheaper than using your car and reduces emissions. One busload of passengers takes the equivalent of 40 vehicles off the road, saving 70,000 L of fuel and avoiding the emission of nine tonnes of pollutants a year.

Share a ride to school, to work or to other activities. Carpools and van pools are often cost-effective options to driving alone. Consider organizing a car pool with neighbours or co-workers. In Canada, interest in ride sharing is growing, with carpool and van pool programs available in many cities, such as Vancouver, Toronto, Montreal and Halifax. An average van pool of six to eight passengers will emit approximately 7.5 times less pollutants than drive-alone commuting on a per passenger kilometre basis.

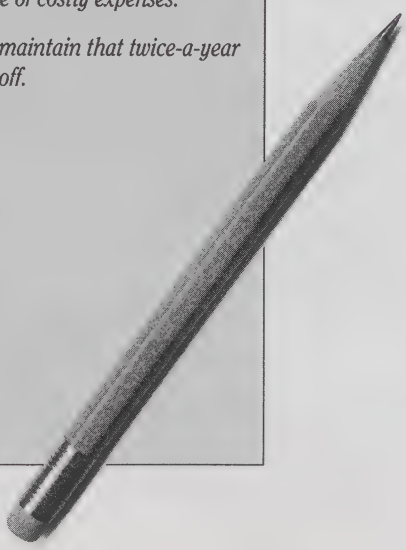
In many U.S. jurisdictions, employers are required to promote ride sharing and transit use to reduce per-person vehicle trips and improve urban air quality.

How to save fuel and money

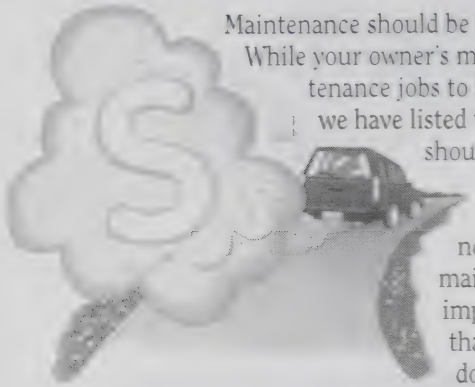
- Combine errands into one trip.
- Turn the engine off rather than letting it idle.
- Get tune-ups regularly. The engine will run more smoothly and efficiently.
- Keep tires inflated to the recommended maximum pressure.
- Anticipate traffic flow, and adjust your speed accordingly.

Keeping your car in shape

- ☑ *How to keep your car in shape.*
- ☑ *Did your vehicle receive a check this month?*
- ☑ *Take this simple test every month – and decrease the chance of costly expenses.*
- ☑ *Auto$mart drivers maintain that twice-a-year maintenance pays off.*



How to keep your car in shape.



Maintenance should be undertaken on a routine basis. While your owner's manual lists all of the maintenance jobs to be done and when to do them, we have listed those checks and tests that should be done to ensure that you have an energy-efficient vehicle. Of course, you don't need to know how to do the maintenance yourself. It is important, however, to ensure that all the checks and tests are done regularly.

Did your vehicle receive a check this month?

The tests on the following checklist should all be conducted when the car engine is *cold*.

1. *Radiator, Hoses to Radiator and Heater:* Inspect visually for leaks and surface cracks.

2. *Coolant:* This should be at the correct level in the radiator overflow bottle. Replenish if necessary with antifreeze. (Caution: Do not attempt to remove radiator cap when the engine is hot.)

3. *Lubrication System:* Check around and under the engine for leaks of oil or other fluids, which could indicate a broken seal or gasket.

4. *Battery:* Check the battery terminals for corrosion, and clean with a wire battery brush, if necessary. Replace any damaged wires or cables immediately.

5. *Belts:* Check drive belts (e.g., fan, air pump, alternator, air conditioner, power steering). Tighten, if necessary, and replace any frayed or cracked belts.

6. *Leaking Fluids:* In addition to having your vehicle serviced according to the maintenance schedule, do a quick daily walk-around inspection to check for leaks.

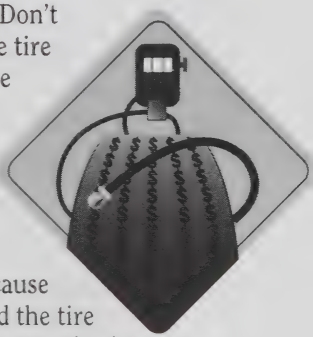
Leaking fluids are not only a sure sign that your car needs repair, but are also harmful to the environment. Routinely inspect the spot where the vehicle is parked for the following signs of possible fluid leaks, and check for fumes:

black or dark brown drippings	→	motor oil or grease
yellow or green drippings	→	coolant or antifreeze
pink or red drippings	→	transmission fluid
clear drippings	→	brake fluid, power steering fluid or gasoline

7. *Fluid Levels:* Have these vital fluids checked regularly: power steering, brake, transmission and differential fluids, underbody lubrication and coolant/anti-freeze (refer to your owner's manual for location of dipsticks). If replenishing is necessary, use only the proper fluids. Top up windshield washer fluid.

   Safely dispose of used motor oil and antifreeze. If you change the oil in your vehicle yourself, do it carefully so as not to spill any on the ground. (Not only is used oil a pollutant, it also contains heavy metals which can contaminate soil and seep into water systems. One litre of engine oil can contaminate two million litres of water.) Return the oil to your local service centre for recycling. Make sure the garage that services your vehicle participates in a system for collecting and recycling used motor oil and fluids.

8. *Tires:* Check tire pressures with an accurate gauge. Don't forget to include the spare tire. Just one tire under-inflated by two pounds per square inch (PSI) will result in a one per cent increase in fuel consumption. It's not uncommon to find vehicles that have six per cent increased fuel consumption because of tire under-inflation.



   Tire inflation pressure also changes because of variation in ambient temperature and the tire heating up under use. Therefore, it is best to check your tire pressure when the tire is cold. Air can be lost from the tire hitting holes and curbs, so it is a good idea to check the pressure frequently. Don't rely on a visual inspection to determine if the tire is under-inflated. Radial tires can look normal and still be under-inflated.

Low tire pressure not only increases fuel consumption, it can also lead to handling problems and casing fatigue, which could eventually cause sudden tire failure. Check your tires regularly for tread wear. If you replace your tires, bring your old ones to a recycling facility.

Take this simple test every month – and decrease the chance of costly expenses.

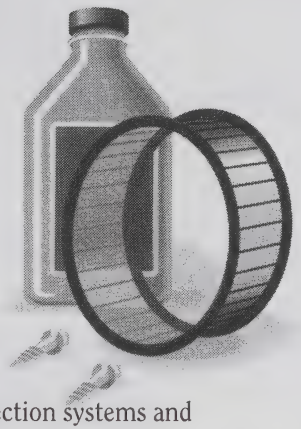
1. *Alignment:* Proper alignment ensures that your tires are pointing in the right direction. Even a marginal misalignment will wear out your tires prematurely. A simple driving test can help you check your car's alignment.

   On a flat, straight, empty parking lot, slowly release your grip on the steering wheel (keeping your hands very near it) and see whether the car continues in a straight line while maintaining an even speed. If the car veers to one side, check whether the pressure is equal in both front tires. If it is, have the alignment checked by a specialist.

2. *Brakes:* Brakes stop your car by converting the forward momentum of your car into heat. Brake calipers hold brake pads in place while pistons squeeze the brake pads against the rotor – very similar to hand brakes on a bicycle. The contact creates friction, which creates heat, causing the car to slow down and eventually stop. Being able to detect some early warning signs from your brakes can save you time, money and fuel.

   On a straight, flat, traffic-free road, rest your hands lightly on the steering wheel and apply the brakes gradually. If the car swerves to one side, one brake lining may be worn more than the other, or the brakes could need adjustment. Check for brake drag by braking your car to a slow rolling stop in the neutral gear. The car should roll freely to a gradual stop with no jerky movements or dragging sound. Check the parking brake by applying it when the car is on a slope and in neutral. The car should not move.

.....Auto$mart drivers claim that twice-a-year maintenance pays off.



Spring and fall are the most common – and appropriate – times to get regular maintenance done.

The items listed below are part of regular maintenance and servicing and should be done in addition to those mentioned in the monthly checklist.

1. *Tune up your car.* Modern carburetors, fuel-injection systems and electronic ignitions are factory-set and should not be tampered with. The servicing of these systems requires special tools and equipment and should be left to a specialist.

2. *Inspect and replace filters regularly.* The air filter is responsible for ensuring that clean air enters your engine. It keeps dust and air-borne impurities from entering and damaging internal engine components. Clogged air filters restrict airflow; this can mean wasted gasoline and higher emissions, so replace these parts regularly. A dirty air filter can cause a 10 per cent increase in fuel consumption. Air filters should be checked once a year (more often, if you drive on dusty roads).

3. a) *Change the oil.* Oil is your engine's "lifeblood". It reduces wear caused by friction between the moving parts and removes acids, sludge and other harmful substances from your engine. Oil also helps to cool the engine, provides a seal between the cylinder walls and the pistons, and prevents the engine from rusting.

   Eventually, the oil becomes contaminated and its performance additives used up, so it is important that the oil be changed regularly. Neglecting to replace worn-out oil can result in severe damage to your engine. The oil filter should be changed with every oil change. At the same time, check levels of oil and power steering, brake, transmission and differential fluids (refer to your owner's manual for the location of dipsticks).

3. b) *Use the right motor oil.* Some types of oil contain additives that reduce friction and increase fuel economy by three per cent or more. These products are marked "Energy Conserving II". Re-refined oil certified with the *EcoLogo* performs as well as motor oil from original sources.

4. *Rotate your tires.* Because the front and rear tires perform different functions on your car, they also wear differently. To make your tires last as long as possible, maintain proper tire pressure, have your tires rotated, and have your wheel alignment checked if the tread wear is uneven (e.g., worn on one side only). Consult with the garage that maintains your vehicle about disposal options for used tires.

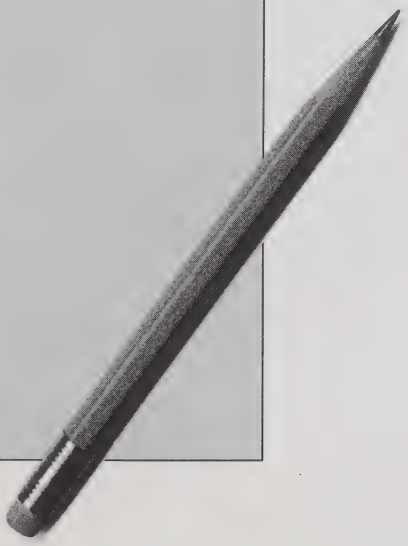
5. *Service air conditioners properly.* An air-conditioned car emits over two kilograms of chlorofluorocarbons (CFCs) over its life cycle, adding to destruction of the ozone layer. Leaks increase emissions further, so fix them promptly.

6. *Have your engine emission controls checked.* The state of your engine emission controls and electronics is the most important variable that affects engine efficiency and emissions. Usually, there is little indication to you that your vehicle is a big emitter. In extreme cases, smoke (unburnt fuel) will be emitted from the tailpipe.

   If the vehicle is a high emitter of carbon monoxide or nitrogen oxides, which are both colourless and odourless gases, you will not know any difference between a working system and a malfunctioning system. The solution is to insist on a check of the emission control system at each tune-up.

Fuel alternatives

Alternative fuels: a great way to overcome a major gas problem.



Alternative fuels: a great way to overcome a major gas problem.

The biggest problem with gasoline, compared to alternative fuels, is the number of impurities it contains.

Alternative fuels have fewer impurities than gasoline and, therefore, produce less carbon monoxide and lower emissions that contribute to smog formation. Some of the alternative fuels also produce less carbon dioxide, a major greenhouse gas.

Alternatives to gasoline are nothing new. Some of the earliest motor vehicles ran on ethanol and electricity. Gaseous fuels such as natural gas and propane have been used around the world as vehicle fuels for many years.

Natural gas and *propane* are gaseous fuels which have grown in use over the past decade. *Ethanol*, mixed with gasoline in low-level blends, is becoming more readily available. *Methanol* fuel is also being introduced to the Canadian market. And exciting technologies, using *electricity* and *hydrogen*, are in the not-too-distant future.

Propane

- About 80 per cent of Canada's propane supply is derived from natural gas. We produce more than we need and export the balance.
- Propane was one of the first alternative fuels to make its way into the Canadian marketplace, and it remains the most popular. Today, there are about 160,000 propane vehicles in Canada and about 3.5 million worldwide.
- Propane is the only alternative fuel available across Canada. There are 5,000 public and 2,000 private stations from coast to coast.
- Propane contributes to improved air quality and produces fewer greenhouse gas emissions than gasoline.

- Vehicles can be converted to operate only on propane, yet most are dual-fuel (gasoline/propane) conversions.
- Vehicle conversions cost on average between $2000 and $2800.
- Vehicle manufacturers are also looking at producing propane vehicles, and there should be several makes and models available soon.
- Users of propane vehicles can realize fuel cost savings of up to 40 per cent.

Natural gas

- Canada has ample supplies of natural gas. Vehicles fuelled by natural gas use the same product that heats many homes and businesses in Canada.
- Natural gas has been used for more than 70 years in other countries. Safe and reliable, it is stored as a compressed gas in pressurized cylinders.
- Natural gas contributes to improved air quality and produces fewer greenhouse gas emissions than gasoline.
- Over 30,000 vehicles operate on natural gas in Canada. There are nearly one million natural gas vehicles worldwide, and the market is growing.
- There are approximately 200 public and private fuel stations in Canada that sell natural gas. As well, a vehicle refuelling appliance that can provide on-site refuelling overnight at any residence or place of business which has natural gas service is now available. Even better, the fuel is priced at the lower heating rate, increasing the fuel savings.
- Many vehicles can be converted to run on natural gas at an average cost between $2800 to $3800. Usually vehicles are converted to dual-fuel systems which allow the vehicle to operate on natural gas, but switch to gasoline when out of range of a natural gas fuelling station.

- The federal government offers incentives of $500 for a natural gas vehicle conversion, $1000 for a factory-produced natural gas vehicle, $500 toward the cost of a refuelling appliance and up to $50,000 for a public or private refuelling station.
- Several different models are already available as factory-produced natural gas vehicles.
- Users of natural gas vehicles can realize fuel cost savings of up to 40 per cent.

Methanol

- Methanol is commonly made from natural gas in North America, but has the potential to be made from renewable sources such as wood and municipal wastes. Canada produces over 10 per cent of the world's total volume of methanol.
- Methanol is used as a transportation fuel, and in the industrial and chemical markets.
- Flexible-fuel vehicles are factory-built vehicles that allow the use of either M85 (a blend of 85 per cent methanol/15 per cent gasoline) or straight gasoline, or any combination of the two.
- The use of methanol offers the opportunity to reduce pollutants contributing to ground-level ozone (urban smog), resulting in improved air quality.
- Flexible-fuel vehicles are growing in popularity. Fuel distribution networks are currently being established across Ontario, Alberta and British Columbia.

Ethanol

- Ethanol can be made from renewable resources such as grain, wood, agro-forestry and municipal wastes. In Canada, most ethanol used as a transportation fuel is produced from corn and grain.
- Ethanol can lead to a net reduction in greenhouse gas emissions when used as a transportation fuel or as a fuel component.
- Most conventional automobiles and light trucks can use gasoline blended with up to 10 per cent ethanol, without any modification to their fuel system or engines, and still be covered by the vehicle manufacturer's warranty. Canadian and U.S. experience shows that, provided ethanol blends are properly prepared to ensure blend stability, vehicle users would notice no driveability problems or customer dissatisfaction. Automobile manufacturers approve the use of ethanol blends in their vehicles and some have included a statement in their vehicle owner's manuals allowing its use.
- There are currently more than 400 stations in Canada offering low-level ethanol blends.
- Fuels containing higher proportions of ethanol (i.e., higher than 10 per cent) require vehicle modifications to optimize combustion and to ensure that the materials in the vehicle fuel system are compatible with ethanol. Engines and passenger vehicles that can use almost pure ethanol are currently under development and demonstration.
- The use of fuel ethanol provides benefits to farmers, through new domestic markets for grain and by-products and the potential for new and alternative crops.

Electricity

- Battery-powered electric vehicles have been around for some time, but until recently, they have been limited in the distance they can travel and the speeds they can reach. Various companies around the world are developing new batteries and other technologies to address these issues.
- Electric vehicles produce no tailpipe emissions. California has adopted a Zero-Level Emission Vehicle (ZLEV) requirement which will require electric vehicles to be introduced into that market by 1998.
- In Canada, the Ballard fuel cell has been introduced in a Vancouver-based transit bus demonstration, the first in the world, using Canadian technology.

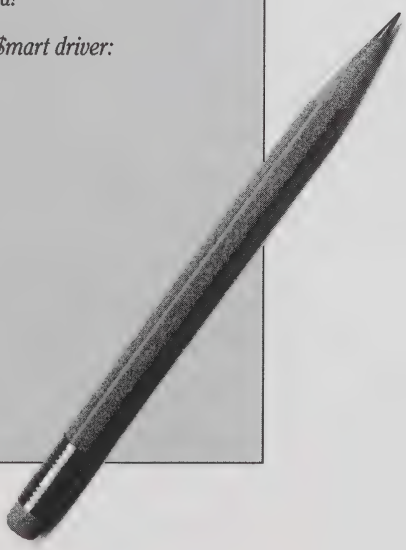
Hydrogen

- There is interest in hydrogen as the vehicle fuel of the future. Hydrogen gas is the most abundant element on earth, yet it must be extracted from compounds, such as natural gas. Hydrogen, when produced from renewable sources, has the potential to be the cleanest alternative fuel.
- The most abundant source of hydrogen is water. Through electrolysis, the hydrogen and oxygen can be separated. Scientists are still perfecting this process but it is not yet cost-effective. It will likely be many years before hydrogen is commercially viable as a vehicle fuel.

Today, alternative fuel vehicles are the exception rather than the norm. Yet this may change in the future. As concern for the environment grows, the demand for alternative fuel vehicles will likely increase.

Your car and the environment

- ☑ *The greenhouse effect: How our driving habits affect the planet.*
- ☑ *Warmer temperatures? Where's the problem?*
- ☑ *Are you a bit hazy on how smog is created?*
- ☑ *Becoming an Auto$mart driver: What's next?*



The greenhouse effect: How our driving habits affect the planet.

Just as the glass of a greenhouse allows sunlight to stream in freely but blocks heat from escaping, carbon dioxide and other "greenhouse gases" (such as methane and nitrogen oxides) let sunshine through, but trap the heat given off by the earth. When these gases build up, too much heat is trapped, and we have global warming.

Your car pumps out twice its weight in carbon dioxide every year.

A major contributor to the greenhouse effect is carbon dioxide, which is produced from the combustion of fossil fuels (coal, oil, gas) in vehicles, industrial boilers and residential furnaces.

The average car pumps over twice its weight in carbon dioxide into the atmosphere each year. Therefore, a poorly maintained vehicle would produce even more CO_2 – possibly three times its weight. About 30 per cent of all carbon dioxide emissions in Canada are from road vehicles and mostly from personal and commercial light-duty vehicles.

Auto emissions contribute directly to smog, acid rain and global warming. In Canada, cars account for 11 per cent of the carbon dioxide, 19 per cent of the nitrogen oxides, 37 per cent of the carbon monoxide, and 23 per cent of the volatile organic compounds (e.g., benzene) released each year as a result of human activity. In addition, most motor vehicles manufactured prior to 1995 are equipped with air conditioners that contain chlorofluorocarbons, a major cause of the thinning of the ozone layer.

The good news is that technological advances are making cars cleaner. Car manufacturers are continually increasing the level of recycling they do in order to reduce energy consumption and produce less waste. And, over the past 20 years, improvements in fuel efficiency combined with better emission-control devices and stricter standards have dramatically reduced emissions of certain pollutants. But chances are, you never noticed.

The number of cars in Canada is increasing. And we're driving them farther and more often.

The number of cars on the road increases steadily. And the distances we drive them, plus the frequency with which we drive them, is also steadily increasing. As a result, while carbon dioxide emissions, for example, have decreased on a per-vehicle basis, overall they are rising.

Catalytic converters and other high-tech control devices greatly reduce automotive pollution, but they do little to prevent the emission of carbon dioxide to the atmosphere because there is no way to burn fuel without releasing carbon dioxide. For every litre of gasoline consumed by an automobile – whether a sleek sports car or a run-down clunker – about 2.5 kg of carbon dioxide spew out the tailpipe and into the air. Over a year, the typical car pumps almost three tons of carbon dioxide into the atmosphere.

Greenhouse gas emissions can be lessened through reduced and more efficient fuel use and by using alternative transportation fuels that result in the release of lower emissions over their life cycle, from production to end-use.

Warmer temperatures? Where's the problem?

The average global temperature in the 1980s was the highest since temperatures have been recorded. This is believed to be a result of the greenhouse effect, also known as global warming. In addition to the warming trend, weather patterns have become less predictable, as we have more heat waves, cold snaps and storms.

Warmer temperatures may sound appealing in the middle of a Canadian winter, but the melting of ice at the North and South Poles could cause major floods and change the face of the earth as we know it. Climate change may mean more rain for some regions of Canada or accentuated dryness for others. Variations in water supply could have an effect on farmers and the crops they grow. Certain species of animals and plants may have trouble adjusting to major changes in our climate, and some may not be able to survive.

Are you a bit hazy on how smog is created?

Smog, the yellow-brown haze that hangs over many cities on calm summer days, is made up in large part of ground-level ozone. Ground-level ozone should not be confused with the blanket of atmospheric ozone, high up in the stratosphere, that protects us from the sun's harmful rays. At ground level, ozone is a serious pollutant.

Nitrogen oxides (NO_x) are produced when we burn fossil fuels such as gasoline or diesel in our cars. Volatile organic compounds (VOCs) are caused by the evaporation of liquid fuels and products manufactured from these fuels such as solvents or household cleaners. Most VOCs, when they react with NO_x in sunlight, produce ground-level ozone or smog. On hot, windless days, these pollutants help to create smog. Because smog formation depends on heat and sunlight, smog usually peaks in late afternoon and early evening.

Reducing smog levels will make us all breathe easier.

Long-term exposure to ground-level ozone (or smog) can irritate the eyes and be harmful to the lungs. Shortness of breath, pain when taking deep breaths, wheezing, fatigue, headaches and nausea can all result from exposure to smog. Ozone harms the air sacs in the lungs where oxygen and carbon dioxide are exchanged. This soft, spongy tissue gradually hardens and reduces the capacity of the lungs. Ozone can also be harmful to vegetation. Ozone damages leaf tissue, leaving visible signs including yellow spots and paper-thin areas. Eventually, the damaged leaves may fall. Varieties of plants that are particularly sensitive to ozone may one day disappear forever.

During the summer, more than half of all Canadians are exposed to high levels of photochemical smog. Ground-level ozone is common around urban centres, where there are many motor vehicles and industries. The most severe episodes of atmospheric ozone pollution in Canada take place in the Windsor-Quebec Corridor, the Lower Fraser Valley and Southern Atlantic Region. Cities such as Calgary, Regina and Winnipeg are also experiencing growing smog problems.

The less industrialized and less vehicle-populated parts of Canada are not immune to ozone pollution. Prevailing winds and weather patterns can transport ground-level ozone and the pollutants that produce ozone hundreds of kilometres to other cities and rural areas. For example, the dominant airflow in eastern North America is northeasterly. Therefore, Atlantic Canada inherits the polluted atmosphere of several large cities along the Eastern seaboard.

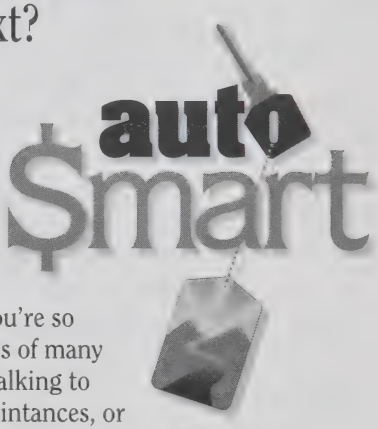
The air we breathe can also contain other pollutants. Carbon monoxide from car exhaust, for example, can reduce the amount of oxygen that is carried by the blood to muscles and organs. Small particles from car exhaust and industrial activities can also carry compounds such as acids and metals into the lungs. Other pollutants can irritate the eyes.

There are many reasons to reduce air pollutants.
The most important reasons are called children.

Children that are still growing are more vulnerable than adults to air pollutants. They are also generally exposed to more air pollutants than adults because they breathe faster and, in the summer, spend more time outdoors being physically active.

Children – and adults – with heart or lung problems, especially asthma, are considered to be more at risk because of their sensitivity to air pollutants in general, and, when air pollution levels are high, they may experience a worsening of their condition.

Becoming an Auto$mart driver: What's next?



You have a lot of power.

As a consumer, you have the power to choose the *type* of car you drive, how *often* you drive and *how* you drive (or don't drive).

You even have the power (if you're so inclined) to increase awareness of many of the issues in this book, by talking to friends, neighbours and acquaintances, or writing letters to companies, governments and the media.

The extent to which you become an Auto$mart driver is up to you.

We encourage you to take what you've read and turn it into practice. By purchasing, driving and maintaining your car the Auto$mart way, you'll save money, energy and the environment.

GLOSSARY OF AUTOMOTIVE TERMS

ACCELERATOR: Controls the amount of fuel and air entering the engine.

ADDITIVE: Chemical that is added in relatively small amounts to gasoline or oil.

AIR CLEANER: Filter assembly that removes dust from the air being drawn into the fuel-metering system.

AIR INJECTION: Emission-control system that mixes fresh air with exhaust gases to consume unburned fuel.

ALIGNMENT: Process of positioning wheels into a correct relationship with each other.

ANTIFREEZE: Chemical solution that lowers the freezing point of engine coolant.

BRAKE: (See *Disc Brakes, Dual Brakes, Hydraulic Brakes, Power Brakes*.)

BRAKE FADE: Loss of braking effectiveness because of excess heat in the drum-brake linings or disc-pads.

BRAKE FLUID: A hygroscopic liquid (absorbs water) with a high boiling point. Used in a hydraulic brake system. Must be kept in a tightly sealed container or the boiling point will be reduced, resulting in a reduction in braking force.

BRAKE LINING: Friction-producing asbestos compound attached to the brake shoes that is pressed against the brake drum during braking.

BRAKE SHOES: Curved metal plates that hold the brake linings in a drum-brake system.

CARBON-FOULED: Build-up of carbon deposits on engine parts or spark plug electrodes. Fouled plugs may misfire, causing a loss of power and wasting fuel.

CARBON MONOXIDE: Colourless, odourless, deadly substance in exhaust gas. Chemical symbol is CO.

CARBURETOR: Device that mixes air and fuel for burning in the combustion chamber of the engine.

CATALYTIC CONVERTER: Component of the exhaust system that converts certain exhaust pollutants into harmless substances. Engine must be run on unleaded gasoline.

CHOKE: Butterfly valve at the top of a carburetor that restricts the amount of entering air and thus enriches the fuel mixture.

CLUTCH: Coupling device used to engage or disengage the flow of power from one moving part to another, such as from an engine to a transmission.

COOLANT: Liquid used in the engine cooling system; usually a mixture of water and antifreeze.

CYLINDER: Hole in the engine block in which a piston moves and combustion takes place.

DIESEL ENGINE: Internal combustion engine that ignites fuel solely by means of the heat of highly compressed air within its cylinders.

DISC BRAKES: Braking system that employs rotating steel disc and a caliper containing pads that pinch the disc to produce stopping friction.

DISTRIBUTOR: Electrical switching device that controls the production and distribution of the high-voltage charges to the spark plugs in the correct sequence.

DOWNSHIFT: Action of shifting a transmission to a lower gear.

DRIVE BELT: A reinforced rubber belt, usually with a V-shaped cross-section, used to drive various engine accessories such as the alternator, air-conditioning compressor and water pump.

DUAL BRAKES: Braking system that provides two separate, independent hydraulic circuits for each pair of wheels.

DYNAMOMETER: Instrument for measuring the power output of an engine.

ENGINE BLOCK: Main part of an internal combustion engine containing the cylinders.

EXHAUST PIPE: Pipe that leads from the exhaust manifold to a catalytic converter, muffler, or resonator.

FILTER: Device or substance that removes foreign particles from air or fluids.

FOUR-STROKE CYCLE ENGINE: Engine that requires four strokes of each piston (intake, compression, ignition and exhaust) to complete its power-producing combustion cycle.

FOUR-WHEEL DRIVE: Vehicle design in which all four wheels are driven by the engine.

FRAME: Steel components that support the car's body and engine and are in turn supported by the suspension.

FUEL INJECTION: Carburetorless fuel system that sprays a programmed amount of fuel into the intake manifold (cylinder for diesel engines) of an internal combustion engine.

FUEL PUMP: Mechanical or electrical device that moves fuel from the fuel tank into the carburetor.

GENERATOR: Electromagnetic device that converts mechanical power into electricity.

HYDRAULIC BRAKE: Brake that is activated by fluid moving under pressure. Most automobile brakes employ this method.

HYDROCARBON: Chemical compound of hydrogen and carbon; all petroleum fuels are composed of hydrocarbons.

IGNITION SYSTEM: Part of an automobile's electrical system that produces and distributes the sparks to ignite the fuel mixture in the cylinders.

MUFFLER: A device between the exhaust pipe and the tail pipe that quiets engine sounds and cools exhaust gases.

MULTIVISCOSITY OILS: Engine oils that have flow characteristics which ensure adequate lubrication at both high and low temperatures.

OCTANE RATING: Index of anti-knock properties in gasoline; the higher the octane rating, the less likely that the gas will cause knock.

OIL FILTER: Replaceable filter element that removes foreign particles from oil.

OIL PUMP: Mechanism that forces lubricating oil under pressure through an engine.

OVERDRIVE: Gear ratio designed into most transmissions that, when selected, allows the drive shaft to turn faster than the crankshaft, resulting in higher speeds with less engine effort and lower fuel consumption.

OVERHAUL: Major disassembly of an engine or other mechanism, and the replacing or reconditioning of its parts.

PARKING BRAKE: Mechanical brake system for locking either front or rear wheels when the car is parked.

PETROLEUM: Thick, flammable liquid of natural origin, consisting of various hydrocarbons, from which products such as gasoline, kerosene and lubricants are distilled.

PISTON: Sliding metal part fitted to operate within a cylinder under hydraulic, mechanical or combustion pressures.

PISTON RINGS: Metallic bands that are fitted into grooves around a piston to provide a tight seal between the piston and the cylinder wall.

POWER BRAKES: Brake system that employs vacuum to augment the force applied to the brake pedal.

POWER STEERING: System that uses a hydraulic-pressure booster to augment the steering force applied by the driver.

PRE-IGNITION: Undesirable ignition of the air-fuel mixture before the spark. Also called knocking or pinging.

RACK AND PINION: Steering system that uses a pinion gear at the end of the steering column to move a toothed bar (rack) left or right to transmit steering movement.

RADIAL TIRE: Tire design in which the cords of the body plies run at right angles (radially) to the tire's centre line.

RADIATOR: Component of the cooling system that dissipates excess engine heat.

SPARK: High-voltage electrical discharge that occurs when current moving though the spark plug jumps across the gap between the metal electrodes.

SPARK PLUG: Porcelain-insulated metal device that conducts high-voltage electricity across a gap between two electrodes to ignite the fuel mixture.

SPEEDOMETER: Instrument that measures the rotation of the drive shaft to indicate road speed.

SUSPENSION: System of springs, arms, shock absorbers and related components that connects a car's body and frame to its wheels and axles.

TAIL PIPE: Section of the exhaust system from the muffler to the rear of the car.

TIMING: Regulation of the spark impulse so that the spark occurs at the precise instant for ignition.

TIRE ROTATION: Systematically switching tires to different wheel positions in order to equalize wear and extend tire life.

TORQUE: A twisting or turning force measured in Newton-metres or foot-pounds.

TRANSMISSION: System of gears, shafts and other components that multiplies engine torque and allows the engine to run at efficient speeds.

TUNE-UP: Process of checking, repairing and adjusting various components of the ignition and fuel systems to obtain maximum engine performance.

TURBOCHARGER: Air compressor powered by exhaust gases; increases the supply of air-fuel mixture to the intake manifold.

VALVE: Mechanical device designed to open, close or restrict the flow of fluid or gas.

VISCOSITY: The resistance to flow of a liquid such as oil.

WHEEL BALANCE: Distribution of weight within a wheel-and-tire assembly; a balanced wheel rotates without vibrating.

Notes

Notes